# PATENT SPECIFICATION 1,042,387

NO DRAWINGS.



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1,042,387



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## COMPLETE SPECIFICATION.

## Heat Exchangers.

We, SERCK TUBES LIMITED, of Warwick Road, in the City of Birmingham 11, a British Company, do hereby declare the invention, for which we pray that a patent may be granted to us, and the method by which it is to be performed, to be particularly described in and by the following statement:

This invention relates to heat exchangers for transferring heat between two fluids. It quite frequently occurs that at least one of the two fluids is liable to deposit sludge or living matter liable to promote undesirable growths on the surfaces of the heat exchanger. Under these circumstances the heat exchanger will suffer a rapid loss of efficiency owing to the building up of a poorly conductive layer on the heat transfer surfaces of the heat exchanger (i.e. the surfaces of those elements which separate the two fluids) and/or owing to the restriction of the flow passages within the heat exchanger.

It is accordingly an object of the invention to provide a heat exchanger in which the above disadvantage is at least partially overcome.

In accordance with the invention the fluid-separating heat transfer elements of a heat exchanger are each provided on at least one fluid engaging surface with a thin coating of polytetrafluoroethylene or a similar fluorocarbon resin material.

Where both fluids are likely to cause the above mentioned effects, then both fluid-engaging surfaces of each heat transfer element may be coated.

The invention also resides in a heat transfer element for use in the construction of a heat exchanger and coated on one or each surface with polytetrafluoroethylene or a similar fluorocarbon resin material. The heat transfer elements may be in the form of tubes or plates.

In one example of the invention a heat exchanger comprises a plurality of tubes which are interconnected and which extend through a hollow casing. The interior surface of each of the tubes is provided with an extremely thin coating of polytetrafluoroethylene (or a similar fluorocarbon resin material). This coating is obtained by creating a porous surface structure on the tube by chemical treatment (i.e. by etching or oxidising to produce an oxide film) spraying or sintering and then applying to the porous surface, a quantity of the p.t.f.e. in dispersion. The thickness of the porous surface structure should not exceed 5 microns. Subsequent sintering causes the particles of p.t.f.e. absorbed into the surface layer of the tube to unite and so form a composite structure of porous metal and p.t.f.e. The thickness of the p.t.f.e. coating should preferably not exceed 5 microns. It may occur that the coating is thinner than the porous surface structure in which case parts of this structure will project from the sintered coating.

In use one fluid is circulated through the casing around the tubes whilst the other fluid which may contain sludge and other depositable impurities is passed through the tubes. Heat transfer takes place in the normal way but the build up of poorly conductive material on the inner surfaces of the tubes is prevented by the p.t.f.e. coating. Owing to the extreme thinness of the p.t.f.e. coating there is substantially no change in the conductivity of the tubes.

If desired the tubes may be coated on both surfaces and two sludge-laden fluids may then be employed. It may also be desirable to coat the interior surface of the casing.

The invention may also be applied to heat exchangers in which the heat transfer elements are in the form of plates. In such heat ex-

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changers the plates are stacked and ports in the plates communicate alternately with the spaces between the plates to form two flow paths for the fluids. The plates may be coated on one or each surface as before.

Our copending application No. 11619/64 (Serial No. 1,042,386) relates to the use of fluorocarbon synthetic resin materials on the condensing surfaces of condensers for steam and other vapours.

WHAT WE CLAIM IS:—

1. A heat exchanger including fluid-separating heat transfer elements each of which is provided on at least one fluid-engaging surface with a thin coating of polytetrafluoroethylene or a similar fluorocarbon resin material.

2. A heat exchanger as claimed in claim 1 in which each heat transfer element is coated on both fluid engaging surfaces.

3. A heat exchanger as claimed in claim 1 or claim 2 in which each transfer element is provided with its coating or coatings of polytetrafluoroethylene or similar fluorocarbon resin material after treatment to provide the element with a porous surface structure into which at least a part of the coating material is absorbed.

4. A heat exchanger as claimed in claim 3 in which said porous surface is provided by a non-metallic film.

5. A heat exchanger as claimed in claim 4 in which said film is a film of an oxide of metal from which the heat transfer element is formed.

6. A heat exchanger as claimed in claim 3 in which the porous surface is metallic.

7. A heat exchanger as claimed in claim 6 in which the porous surface is formed by adding a layer of porous metal to the element.

8. A heat exchanger as claimed in claim 7 in which said layer of porous metal is added by sintering on a layer of powdered metal.

9. A heat exchanger as claimed in claim 7 in which said layer of porous metal is added by metal spraying.

10. A heat exchanger as claimed in claim 6 in which the porous surface structure is formed by selective etching.

11. A heat exchanger as claimed in any one of claims 3 to 10 in which the porous surface structure has a thickness of less than 5 microns.

12. A heat exchanger as claimed in any one of claims 3 to 11 in which the coating is formed by applying a dispersion of the polytetrafluoroethylene or similar fluorocarbon material to the porous surface and sintering.

13. A heat exchanger as claimed in claim 12 in which the coating has a thickness of less than 5 microns.

14. A heat exchanger as claimed in claim 13 in which the thickness of the coating is less than the thickness of porous surface structure so that parts of the latter project from the coating.

15. A heat exchanger as claimed in any preceding claim in which the heat transfer elements are in the form of tubes extending through a hollow casing.

16. A heat exchanger as claimed in claim 13 in which the tubes are coated internally and externally and the interior of the casing is also provided with a thin coating of polytetrafluoroethylene or similar fluorocarbon resin material.

17. A heat exchanger as claimed in any one of claims 1 to 14 in which the heat transfer elements are in the form of plates formed into a stack and having ports communicating alternately with the spaces between adjacent plates.

18. A heat transfer element for use in the construction of a heat exchanger and coated on at least one surface with polytetrafluoroethylene or similar fluorocarbon material.

19. A heat transfer element as claimed in claim 18 in which the coating is applied after the surface of the element has been treated to produce a porous surface structure which absorbs at least a part of the coating.

20. A heat transfer element as claimed in claim 19 in which the thickness of said surface structure is less than 5 microns.

21. A heat transfer element as claimed in claim 20 in which the thickness of the coating is less than the thickness of said porous surface structure so that, parts of the latter project through the coating.

22. A heat transfer element as claimed in any one of claims 18 to 21 in the form of a tube internally provided with said coating.

23. A heat transfer element as claimed in claim 22 in which the tube is also provided with a coating externally.

24. A heat transfer element as claimed in any one of claims 18 to 21 in the form of a plate.

25. A heat transfer element as claimed in claim 24 in which the plate is coated on both surfaces.

26. A heat transfer element substantially as hereinbefore described.

27. A heat exchanger substantially as hereinbefore described.

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